

**IDAHO DEPARTMENT OF FISH AND GAME**

**ANNUAL REPORT  
CABINET GORGE FISH HATCHERY  
1993**

**Prepared by:**

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## INTRODUCTION

Cabinet Gorge Hatchery is located in Bonner County, Idaho approximately eight miles southeast of the community of Clark Fork. Constructed in 1985, the hatchery produces advanced-stage late-spawning kokanee salmon fry for Lake Pend Oreille. These fry are needed to mitigate for the loss of wild kokanee recruitment caused by hydroelectric power projects on the Pend Oreille watershed. The hatchery times the kokanee fry release to coincide with the altered cycles of zooplankton blooms in the lake caused by Mysis shrimp.

Staffing at the hatchery includes two permanent personnel, one temporary year-long maintenance craftsman, eight months of bio-aide time, and 17 months of temporary laborer time. Housing accommodations include two residences for the permanent staff and crew quarters for two seasonal employees.

### Water Supply

Cabinet Gorge Dam is located about one mile upstream from the hatchery. After the dam's completion in 1952, artesian springs appeared along the Clark Fork River at the present site of the hatchery. The hatchery uses six pumps to exploit these springs. Two separate well fields provide up to 20 cubic feet per second (cfs) of well water to the hatchery. The lower spring and the upper well field water temperatures vary inversely over a 12-month period. A mixture of the two water sources allows incubation and feed training water to be kept around 50°F (range 48°F to 51°F). Production water ranged from 39°F to 51°F.

### Rearing Facilities

Rearing facilities at the hatchery include 192 upwelling incubators and 64 concrete raceways. The incubators are 12 inches in diameter by 24 inches high with a capacity of 110,000 kokanee eggs each. The 64 concrete raceways have a total rearing space of 32,000 cubic feet. Approximately one-third of each raceway-is enclosed by the hatchery building. The adult kokanee holding area consists of two holding ponds (10 ft x 30 ft each) at the head of the fish ladder, and additional adult holding is available in three holding ponds (10 ft x 30 ft each).

## PRODUCTION

Between January 1, 1993 and December 31, 1993, Cabinet Gorge Hatchery released or had on hand a total of 2,171,496 fish weighing 34,806 pounds remaining from the 1992 production year. A total of 36,867 pounds of fed produced 23, 581 pounds of gain for an overall conversion of 1.56. Average cost per pound of feed was \$0.49, resulting in a feed cost per pound of fish of \$0.76. Total production cost (less capital outlay) was \$186,420 resulting in a cost per pound of fish of \$5.36 and \$85.85 per thousand fish (Appendix A). In addition, 9,144,000 Lake Pend Oreille kokanee eggs and newly hatched fry from the 1993 fall spawn were on hand December 31, 1993.

## Lake Pend Oreille Kokanee

### General Rearing

Fertilized eggs were brought to the hatchery building and disinfected in 100 ppm Argentynine for 15 minutes. After enumeration by volumetric displacement, the green eggs were rolled in the upwelling incubators. At eye-up, the flow through the incubators was increased to maintain the egg rolling. Five days after hatch the fry were sorted with slotted screen to remove infertile eggs and dead matter. Swim-up fry were allowed to swim out of the incubators into the raceways at 1,650 temperature units. Feed training began at 1,670 temperature units.

Kokanee were feed-trained at 50°F using Rangens soft-moist starter for the first week, then this feed was mixed with Bio-Products Bio-Diet Starter #3. After this initial feed training, the fish were reared on Bio-Products Bio-Diet Grower 1.0 to 1.3 mm pellet depending on fish release size objectives. These size objectives have changed from 1.3-inch fry when the hatchery began operation, to the present request of 2.2-inch fry at release. To meet this request, the hatchery capacity has been reduced from 30 million to 16 million fry.

Because egg collection lasts over two months and a cross-section of the run is required for each release strategy, growth rates are adjusted according to release timing. The growth rates of the early egg takes are slowed by decreasing the water temperature. The late egg take growth is increased by raising the water temperature and the feeding rate. By adjusting these parameters after the fry are feed-trained, a representative sample can be obtained from each egg take, thus assuring optimum genetic diversity in each release.

A total of 621,506 kokanee fry were produced at an average length of 2.4 inches and an average weight of 243.9 fish per pound. These fish gained 2,213 pounds from 3,085 pound of feed, resulting in a conversion rate of 1.39:1.0. Fish feed production cost was \$0.753 per pound and \$2.68 per thousand.

Survival of green eggs to feeding fry was estimated at 14% (1992, 91%). Survival from first feeding to release was estimated at 52% (1992, 92%), resulting in survival from green egg to release of 8% (1992, 84%).

The poor kokanee survival for the 1993 production is attributed to the loss of incubation water. The failure of the back-up generator to start during a power outage December 23, 1992 caused the incubating eggs to be without flowing water for 20 minutes.

### Fish Marking

The 1993 release group had run-represented sample groups fin-clipped. A total of 70,000 Sullivan Springs released kokanee were marked with an adipose fin clip.

### Fish Liberations

A total of 561,146 kokanee fry were transported from Cabinet Gorge Hatchery to Sullivan Springs. The remaining 60,360 kokanee were held at the hatchery for use in the broodstock program. Numbers at release were based upon partial inventory numbers and raceway consolidation estimates made after mortality rates

stabilized. All numbers were checked with a weight/sample count number as the fish were loaded onto the trucks for Sullivan Springs. No fish were released at the hatchery ladder.

Kokanee were imprinted with a morpholine drip of  $5 \times 10^{-5}$  ppm for 30 days prior to release and for two days after release.

#### Sullivan Springs

All kokanee fry were released at Sullivan Springs. The releases were at both bridges on Sullivan Springs. Clark Fork Fish Hatchery provided a 2-ton truck and a 1-ton truck for transporting the fry. A pool in the stream was scoured out below the upper bridge for the 1-ton truck releases. The 2-ton truck released fry below the lower bridge using a 30-foot length of 10-inch plastic hose to provide a soft release. The four releases occurred July 15-16, 1993.

#### Other Fish Produced

##### Lake Pend Oreille Broodstock Kokanee

In 1989, an experimental kokanee broodstock program was started at Cabinet Gorge Hatchery. These kokanee are being held as a captive broodstock to enhance declining kokanee populations in the lake.

Kokanee (1989 BY)-There were 2,000 brood year 1989 kokanee remaining on January 1, 1993 following the 1992 spawning. None of these survived to spawn in 1993. From the 1992 broodstock spawn collection of 227,655 green eggs 8,900 fry survived and were released in 1993.

Kokanee (1990 BY)-About 1,225 brood year 1990 kokanee averaging 11.2 inches were on hand December 31, 1993. These were all spawned by the end of January 1994. The final spawn numbers are 298 females yielding 137,772 green eggs. At spawning the fish averaged 11.2 inches in total length and 2.1 fish per pound.

Kokanee (1991 BY)-There were 21,561 brood year 1991 kokanee averaging 8.02 inches and 5.1 fish per pound on hand December 31, 1993.

Kokanee (1992 BY)-There were 44,399 brood year kokanee averaging 5.2 inches and 23.8 fish per pound on station December 31, 1993.

##### Bull Trout

A bull trout culture program was established at Cabinet Gorge Hatchery in 1987 to advance the knowledge of bull trout culture and provide bull trout fingerlings to fisheries managers for reestablishment or enhancement of suppressed populations in Idaho. However, because of concerns about adversely affecting the genetics of the wild population in the lake with the introduction of hatchery fish from a limited number of parents, plus the unknown predator/prey relationship, this program was discontinued in 1991. The remaining bull trout

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were held for rearing to 10 inches or larger. These fish were released in mountain lakes as a predator to reduce stunted brook trout populations.

1990 Bull Trout-On January 1, 1993, there were 3,813 bull trout on station. Of these, 2,863 fish survived to be released in selected mountain lakes across Idaho. The released fish averaged 11.5 inches in total length and 1.8 fish per pound.

#### Deadwood Kokanee

On January 1, 1993, there were 1,924,753 early-spawning Deadwood kokanee on station. Of these 546,627 fry were released in selected lakes and reservoirs across Idaho. The released fish averaged 2.4 inches and 236.4 fish per pound.

#### Colorado Kokanee

On January 1, 1993, there were 294,250 late-spawning Colorado kokanee on station. This stock was severely impacted by the power outage, with 15,332 fry surviving to plant into Lucky Peak Reservoir. The average stocking length was 2.1 inches at 359 fish per pound.

#### Hayspur Rainbow Trout

On January 1, 1993, there were 1,083,000 rainbow trout alevins from Hayspur Fish Hatchery on station. In May and July, 876,857 fry were transferred to Hagerman State Fish Hatchery. The fish averaged 2.5 inches in total length and 161 fish per pound.

### HATCHERY IMPROVEMENTS

#### Improvements include:

- Erected a spawning shelter at the Clark Fork River fish trap.
- Added pump #8 to back-up generator.
- Carpeted the office and dormitory.
- Provided access to pumps for service vehicles.
- Mounted stationary ladders on the headbox.
- Relocated the alarm system batteries.

#### Repairs include:

- Returned pump #3 to service with necessary adjustments.
- Rebuilt pump #5 motor, line shaft, line bearings, and packing glands.
- Rebuilt pump #6 pressure relief valve.
- Replaced Granite Creek trailer floor.
- Repaired drop structures in Sullivan Springs.
- Replaced carpet in Residence #1.
- Serviced back-up generator, replaced batteries and needed accessories.
- Repaired pump #8 back-flow valve.

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Methods used include:

- Developed daily, weekly, and monthly checks of back-up generator and related alarms.

#### HATCHERY RECOMMENDATIONS

The limiting factor in fish growth remains inadequate amounts of warm water (50°F) during the production months. The upper well field yields up to 20 cfs during the production cycle, however the water is too cold for incubating and feed training. Warmer water from the lower springs wells must be added to temper the upper field water. The 4.4 cfs available from the lower springs well is insufficient to effectively temper the upper well field. A new well field intermediate in temperature is needed.'

The adult ladder and holding ponds are operated with reuse water from the hatchery through the settling pond. An effective intermediate well field would free the lower springs wells to provide clean, cool water to operate the fish trap. An adequate degassing tower would be needed in addition to some added plumbing.

The fish loss of 1993 demonstrated the vulnerability of rearing fish with pumped water. An additional water backup is needed to further reduce the likelihood of a repeat water pumping failure. Options to consider include an additional backup generator, a direct power line from the hydropower dam and a water storage system to provide gravity flow water for a given length of time.

#### FISH HEALTH

IDFG Fish Health Laboratory personnel conducted all of the fish examinations and Doug Burton, Fish Pathologist, made the following comments.

From a fish health perspective, 1993 was an unfortunate year at Cabinet Gorge Hatchery. First, the kokanee fry which survived the initial power outage/water loss disaster continued to experience elevated mortality rates during early rearing. These groups were sampled repeatedly from January through April for virology and histopathology (Appendix B). The fish were too small to sample for standard bacteriology or fluorescent antibody techniques. No viruses were detected at any time, but the initial histologic examination detected coagulated yolk, muscular edema, gill hyperplasia, kidney degeneration and abnormalities in the swim bladder (including exogenous debris within the bladder). the diagnosis was environmental stress which caused coagulated yolk disease and toxicity, with secondary environmental gill disease and swim bladder problems. Subsequent samples showed an obvious progression of the above afflictions. Treatment for the gill disease may have helped in the short-term, but the best lessons learned were to avoid the initial dewatering at all costs and to refrain from aggravating some of the resulting problems.

Next, the bull trout began to have elevated mortalities in June and July. many demonstrated external lesions with mild hemorrhage that did not extend into the underlying muscle tissue. Samples were sent to the Eagle Fish Health Laboratory where motile Aeromonas and Pseudomonas species were isolated. It is possible that the bacteria were secondary invaders following stress and injuries from unconventional fish behavior related to conventional fish culture practices. One of two 3-fish pools were also positive (low) for Renibacterium salmoninarium (RS) by ELISA.

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Valuable lessons were learned in how to culture wild bull trout which should be documented for use if the Department ever decides to rear them again. One recommendation would be to sample the broodstock to evaluate the incidence of bacterial kidney disease (BKD) in the population before placing them in a hatchery. This might answer the question of whether the above fish were infected vertically with RS or whether they were later exposed in the hatchery.

Finally, the 1990 brood year kokanee, held on station as captive broodstock, were diagnosed in August with clinical BKD and the 1991 brood year fish were diagnosed as carriers. Clinical signs were later observed in the brood year 1991 fish.

The presence of clinical BKD lowers the Cabinet Forge Hatchery disease classification from a Class A "Quarantine" facility to a Class C. It will require the removal of the infected fish, disinfection of the facility, and three years of negative sampling results before the hatchery can be reclassified as "A." The significance of this lower classification is that Cabinet Gorge cannot ship eggs or fish to other Class A or B hatcheries without reducing the classification of the receiving facilities. Stocking of fish from Cabinet Gorge is also now restricted to waters which have historically had RS.

Inspection of the kokanee returning to Granite Creek and to the hatchery ladder also provided some disturbing information. All fish were negative for viruses and the Granite Creek fish were negative for BKD. The fish returning up the Clark Fork River to the hatchery ladder tested positive for BKD by both FAT and ELISA. The fish sampled from Granite Creek and the Clark Fork River were essentially the same fish when released from the hatchery. There must be some factor following releases, perhaps in the Clark Fork River, which is causing a higher rate of infection to occur. This situation definitely deserves investigation because BKD may be adversely affecting survival of kokanee in Lake Pend Oreille, and because presence of the disease will prevent Cabinet Gorge Hatchery from being reclassified as mentioned above.

Immediate recommendations for Cabinet Gorge Hatchery are to phase out the captive broodstock program, then fully disinfect the hatchery. The original purpose of Cabinet Gorge Hatchery is to rear Lake Pend Oreille kokanee. Therefore, we may need to initiate a BKD management program which will include isolation of Granite Creek fish from Clark Fork River fish and the use of chemical therapies. Investigational New Animal Drug (INAD) permits are in place for the use of erythromycin at Cabinet Gorge, and the Eagle Laboratory pathologists have begun the application process to test enrofloxacin on the 1991 captive brood fish.

## FISH SPAWNING

### Fish Trapping

During 1993, the Clark Fork River fish trap was in operation from October 15 to the last week of December. Kokanee began entering the trap immediately, with the last kokanee trapped and spawned on December 20. There were 49,187 fish trapped, with sampled counts indicating 29.4% of the spawning run was female (14,461). Due to fish health concerns and holding pond limitations, some of the Clark Fork River kokanee were moved off site to other holding ponds. Clark Fork Fish Hatchery received 7,717 kokanee and Sandpoint Fish Hatchery received 1,460 kokanee.

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The Sullivan Springs trap collected 130,323 fish of which 35,444 were females (27.2%). A total of 9,642 kokanee were passed above the trap to spawn naturally in Sullivan Springs Creek.

#### Spawntaking

Clark Fork River kokanee spawntaking began on October 26 and continued to January 10, 1994. Spawntaking ran from November 8 to December 30 at the Sullivan Springs fish trap. The 1990 brood year kokanee spawntaking began November 16 and ended January 20, 1994.

A total of 11,233,915 kokanee eggs were collected during the 1993-1994 spawning operation. The Clark Fork River run yielded 1,059,648 green eggs, Sullivan Springs yielded 10,037,495 eggs, and the captive broodstock 136,772 eggs (Appendix C).

#### EGGS RECEIVED

##### Deadwood Kokanee

About 2,235,800 green early-running kokanee eggs from Deadwood Reservoir in central Idaho were received in mid-September 1993. As of December 31, 1993, about 1,075,800 early kokanee fry were on hand averaging 0.83 inches. These fish will be used for lowland lake stocking.

##### Colorado Kokanee

About 942,736 eyed eggs from late-spawning kokanee from Blue Mesa Reservoir, Colorado were received from the Colorado Game and Fish Department's Roaring Judy State Fish Hatchery on December 1, 1993. At the end of 1993, about 922,024 kokanee sac fry were on station. These fish will be used for lowland lake stocking.

##### Hayspur Rainbow Trout

About 1,494,744 eyed eggs from domestic rainbow trout were received from Hayspur Fish Hatchery during December 1993. These will be transferred as fingerlings to Hagerman Fish Hatchery in late spring of 1994.

#### PUBLIC RELATIONS

The surrounding communities identify Cabinet Gorge Hatchery as the major contributor of kokanee to the Lake Pend Oreille fishery. The economic importance of this fishery has been estimated at over \$5 million. The hatchery has been the focus of many radio, television, and newspaper stories in recent years. This past year's fish loss brought the hatchery national media attention.

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About 600 people signed our guest registration book this year. Numerous tours were given to school groups and other organizations. An estimated 2,000 visitors toured the hatchery during 1993.

#### **SPECIAL STUDY**

Due to the increasing ratio of males to females in late spawning kokanee salmon, a feed experiment was performed from May 5 to August 9, 1993. Prior to the experiment, it was speculated that the increased ratio of males to females was precipitated by high levels of testosterone in processed diets. The experiment involved feeding three diets to six lots of kokanee broodstock progeny (one diet per two lots). The three diets were our production diet of Rangen's semi-moist starter and Bio-diet feed, a diet of freeze-dried krill, and a diet of brine shrimp.

The feed experiment ended August 9, 1993. Thirty fish from each lot (N-180) were randomly selected for sex gender identification. Each of these selected fish were checked for developing internal sex organs. The brine shrimp groups had the highest percentage of females (43-47%) with the Rangen's and Bio-diet groups having the lowest percentage of females (30-37%). The krill fed groups were intermediate to the other groups in sex ratios (40%).

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#### ACKNOWLEDGEMENTS

Cabinet Gorge Hatchery personnel wish to thank the Lake Pend Oreille Idaho Club for providing spawning volunteers and the \$2,600 provided to hire part time spawners. Special thanks to Ned Horner for coordinating regional personnel help and Rob Soumas for coordinating spawning help with IDFG Reservists. Clark Fork Fish Hatchery provided much needed personnel and equipment during 1993 which was essential in our operation of Cabinet Gorge Fish Hatchery.

Appendix A. Production summary, all species, 1992-93.

Species	Number	Pounds	Feed fed	Annual cost	Cost/lb of fish	Cost/1,000 fish	Conversion
Fry							
LPDO KL	621,506	2,213	3,085	130,400	58.92	209.81	1.4
DWD KE	546,627	2,312	3,446	21,000	9.08	38.42	1.7
CO KL	15,332	43	86	6,000	139.53	391.34	10.4
R-9	876,857	5,450	4,887	4,420	0.81	5.04	1.0
Broodstock							
1989 KL	2,806	2,192	50	2,000	0.91	712.76	NA
1990 KL	23,875	11,655	10,956	9,000	0.77	376.96	1.7
1991 KL	37,231	7,293	10,842	6,000	0.82	161.16	2.0
1992 KL	44,399	1,867	2,476	3,600	1.93	81.08	1.5
1990 BU	2,863	1,781	1,039	4,000	2.25	1,397.14	1.1
TOTALS	2,171,496	34,806	36,867	186,420	5.36	85.85	1.6

Appendix B. Summary report of Eagle Fish Health Laboratory results for Cabinet Gorge Hatchery (Class C). January 1 - December 31, 1993.

Brood year	Stock	Species	Accession	IHN	IPN	EIBS	BKD	FUR	ERM	CWD	PKD	WHD	CSH	ICH	GBD	Diagnoses
1992	CG	Kokanee	93-011	-	-											*DX: Environmental toxicity, Stress, CYD GBD(suspect); Viro 0/20
1992	SulvSp	Kokanee	93-042	-	-											DX: Enviro. stress, BGD, Air bladder distention; Viro 0/35
1992	SulvSp	Kokanee	93-055	-	-											DX: Enviro. stress; Viro 0/20
1992	SulvSp	Kokanee	93-076	-	-											DX: Environmental toxicity, Starvation, BGD, Mycosis (gilt), Viro 0/40
1992	CG	Kokanee	93-134	-	-											DX: Environmental toxicity, CYD, BGD, Starvation, Mycosis (gill), Viro 0/30
1991	Cold Ck	Bull trout	93-267	-	-		+	-	-	-						DX: RS, Bacteremia; Viro 0/6, ELISA 3/6 (low), FA 0/6, Bacte 3/6 Ps. <u>fluorescens</u> , <u>Aeromonas</u> sp., <u>Shewanella</u> (Ps.) <u>putrefaciens</u>
1991	CG	Kokanee	93-333	-	-		+									IX: RS; ELISA 2/11 (low), FA 1/60, Viro 0/60
1992	SulvSp	Kokanee	93-335	-	-		-									IX: Negative for pathogens; FA 0/60, Viro 0/60
1990	CG	Kokanee	93-338	-	-		+									DX: BKD, Bacteremia; FA 4/5 (3 TNTC, 1 low), Viro 0/5, Bacte 1/4 <u>Aeromonas</u> sp., 1/4 Flexibacter sp.
1991	SulvSp	Kokanee	93-500				+									DX: BKD; FA 9/10 (8 TNTC), ELISA 2/2 (highs)
1992	SulvSp	Kokanee	93-501				+									DX: RS; FA 2/10 (low) ELISA 1/2 (low)

Appendix B. Continued.

Brood year	Stock	Species	Accession	INN	IPN	EIBS	BKD	FUR	ERM	CWD	PKD	WHD	CSH	ICH	GBD	Diagnoses
Brood	CF Riv.	Kokanee	93-575	-	-		+	-	-	-						IX: BKD, MAS; FA 4/60 (3 mod, 1 high), ELISA 3/12 (2 low, 1 mod), Bacte 8/12 ( <u>Aeromonas sobria</u> 5/12, <u>Flavobacterium</u> 3/12), Viro 0/60
Brood	CF Riv.	Kokanee	93-576	-	-		+					-				IX: BKD; ELISA 3/4 () low, 2 high pools) FA 6/20 () light, 4 mod, 1 heavy), WHD 0/20, Viro 0/20, Bacte 2/4- <u>Flexibacter</u> sp. (negative to F. <u>psychrophilus</u> antisera)
Brood	SulvSp	Kokanee	93-577	-	-		-	-	-	-		-				IX: Negative for pathogens; Viro 0/60, FA 0/60, WHD 0/20, ELISA 0/60, Bacte NSG
IHN	Infectious Hematopoietic Necrosis virus															
IPN	Infectious Pancreatic Necrosis virus															
EIBS	Erythrocytic Inclusion Body Syndrome virus															
BKD	Bacterial Kidney Disease ( <u>Renibacterium salmoninarum</u> )															
RS	Positive for <u>Renibacterium salmoninarum</u> but not clinical disease															
FUR	Bacterial Furunculosis ( <u>Aeromonas salmonicida</u> )															
ERM	Enteric Redmouth Disease ( <u>Yersinia ruckeri</u> )															
CWD	Coldwater Disease ( <u>Flexibacter psychrophilus</u> )															
PKD	Proliferative Kidney Disease (PKX)															
WHD	Whirling Disease ( <u>Myxosoma cerebralis</u> )															
CSH	<u>Ceratomyxa shasta</u>															
ICH	<u>Ichthyophthirius multifiliis</u>															
GBD	Gas Bubble Disease															
HAS	Motile Aeromonad Septicemia															
CYD	Coagulated Yolk Disease															
BGD	Bacterial Gill Disease															
NSG	Nonsignificant Growth															
TNTC	Too Numerous To Count															
IX	Inspection (routine hatchery visit)															
DX	Diagnostic (sampled because of sick fish)															

Appendix C. Lake Pend Oreille kokanee spawning summary, 1993.

Spawning location	Total fish	Females spawned	Green eggs	Percent fecundity	Females
Granite Creek	130,232	31,577	10,037,495	318	26.2
Clark Fork River	49,187	3,013	1,059,648	352	29.4
CGKH broodstock	640	298	136,772	459	NA
TOTALS	180,059	34,888	11,233,915	322	

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IDAHO DEPARTMENT OF FISH AND GAME

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Steven M. Huffaker, Chief  
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Costs Incurred:

\$208,500

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Thomas S. Frew  
Fish Hatcheries Supervisor